baseline data and related test and analysis methods, the Science Campaign input includes margin/uncertainty criteria and sensitivities of performance to material properties used to develop aging models and lifetime assessment tools. Integration of the Engineering Campaign and RTBF is vital to ensure that the proper investment is made in experimental and computational infrastructure needed to meet the Campaign's milestones. Examples of these facilities include the Test Capability Revitalization, the Ion Beam Laboratory, and the Microsystems and Engineering Sciences Applications facility.

Major FY 2008 Achievements

Enhanced Surety

- An Optical Initiation Firing Set prototype was designed, developed, and delivered.
- Two thermoelectric transducer prototypes, fabricated last fiscal year, for use in future weapon systems were performance tested.
- A third prototype for the highest priority surety sensor technology was developed based on a new technology.
- Designed, fabricated, assembled, bench-top and environmentally tested Dual Stronglink Mechanism prototype hardware.
- Parametric material studies on Multi-Point Safety (MPS) options were conducted at Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL).
- Under the Enhanced Collaboration effort with the United Kingdom, the subprogram shares the load and cost of experimental activities through facility leveraging and exhibits complementary development of certification tool calculation capability, internationally expanding stockpile safety applications.

Weapon Systems Engineering Assessment Technology

- Four datasets to include Beryllium creep properties at elevated temperatures; creep of PBX 9501 – a joint effort between test labs at LANL and LLNL examining material and test facilities' impact on observed creep behaviors; 3D Digital Image Correlation (DIC) data analysis; and coefficient of Thermal Expansion tests of PBX 9501.
- Developed an effective thermal conductivity characterization tests sensitive to repeatability of the assembly.
- Identified the transferability of embrittlement properties from coupon tests to geometries of interest and identified the critical stainless steel material inputs for the fracture code underdevelopment by the University of Illinois.
- Successfully scaled up the new technique for ground-based testing of flight and re-entry environments combining acceleration, vibration, and spin.
- Provided performance assessment validation data on the highest priority surety component characterizing the mechanical and thermal, response of material over a range of environments.
- Published the 1st edition of a Joints Handbook consolidating the results of computational, theoretical, and experimental programs in support of the W76-1 LEP to foster the transition from R&D to Stockpile Applications.

Nuclear Survivability

- Developed and demonstrated protocol specifying methods to establish margins impacting design and qualification of most electronic circuits for reentry systems.
- Developed methodology for studies of age-related changes in device hardness, enabling dose-rate sensitivity changes to be observed.

Detailed Justification

(dollars in thousands)

	FY 2008	FY 2009	FY 2010
Enhanced Surety	**34,137**	**46,112**	**42,000**

Enhanced Surety pursues a multi-technology approach to develop viable options for insertion meeting weapon system designers' specifications during stockpile alterations, modifications, and transformations. This approach will also address other future refurbishments and stockpile improvement projects needed, meeting both NNSA and Department of Defense (DoD) requirements. Multi-technology development and integration opens the design space and offers opportunity for synergistic improvements to other weapon components.

In FY 2010, the focus is on three multi-site development efforts. Sandia National Laboratories (SNL) along with the Savannah River Site and Savannah River National Laboratory will continue to mature power management options with the intent to deliver a near-term viable option for the next insertion opportunity. SNL will continue to mature security sensor technologies ultimately producing prototypical hardware units for production at the Kansas City Plant. Los Alamos National Laboratory and Lawrence Livermore National Laboratory will continue to develop multi-point safety options working in collaboration with the United Kingdom with the intent to apply system integration through SNL into viable options for the next insertion opportunities. The subprogram, aside from the three multi-site efforts, will develop integrated surety solutions, which integrate external surety elements with the weapon, thus allowing the weapon to have the capability to better react to external activities addressing current threat scenarios.

Weapon Systems Engineering Assessment Technology	**18,814**	**16,592**	**18,000**

The Weapon Systems Engineering Assessment Technology (WSEAT) subprogram uses engineering computational models in collaboration with the Advanced Simulation and Computing (ASC) Campaign to predict weapon system response to three Stockpile-to-Target Sequence environments: normal, abnormal, and hostile. The activity also supports manufacturing development of critical components and subsystems; e.g., neutron generators, gas transfer systems, and microsystems. The subprogram objective is to establish the capability to predict engineering margins by integrating numerical simulations with experimental data. Validated computational tools are required to explore the operational parameter space of the nuclear weapons stockpile. Exploration of operational parameter space identifies failure modes and boundaries, thus establishing engineering margins.

In FY 2010, the subprogram will focus on producing data sets for code validation in support of current weapon alterations and modifications and legacy stockpile support. Combined efforts between the ASC Verification and Validation, and Physics and Engineering Models programs is a key principle of WSEAT and provides validated modeling and simulation capability for multi-scale and multi-physics problems encountered in qualification and certification activities. Work will continue on non-intrusive instrumentation and high explosive structural property measurements supporting model development for improved assessments of structural response, and margins for insensitive high explosive main charge materials.